NOTES ON THE RESULTS OF EXPERIMENTAL BAFFLES AT MONTEBELLO FILTERS[1]

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When the wooden baffles were first built across the coagulating basin, they were provided with small gates hinged at the top, permitting movement in either direction for the purpose of relieving the baffle of hydrostatic pressure at times of filling and emptying.

The filling was accomplished satisfactorily, but when the time came for removing the mud it had become so firmly compacted against the baffles that the swinging gates could not operate and the baffles collapsed. As the accident happened in cold weather, no attempt was made to repair the baffles until June, 1919, when No. 1 across the north half of inlet side of the basin was rebuilt in its original position and the one on the south half was moved forward about 50 feet. In moving it forward, the sloping bottom of the floor had the effect of lowering the elevation of its top 1.2 feet. The position of the hinges on the swinging gates was changed from the top to the bottom and heavy wooden strips were secured to the top. The buoyancy of the wood shut the gates and held them in position as long as water was in the basin, but as soon as water was withdrawn below the top of the gates, the weight of wood on top and the pressure of water behind opened the gates. No further trouble was experienced when the basins were cleaned, although mud was packed solidly against baffle No. 1 from top to bottom.

The plan, figure 1, and profiles, figure 2, of the basin show the surface of the mud, and the location and elevation of the baffles on December 31, 1919, when a careful survey of the mud surface was made. An inspection of these diagrams indicates that the sediment was carried forward for a distance of about 100 feet, and from that point to baffle No. 1 it was deposited very evenly. At the baffle there was an abrupt drop in the mud surface of about 3 feet, and from

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there on to baffle No. 2 there was some irregularity of deposit, as might be expected, due to the change in direction of the flow. From baffle No. 2 to the skimming weir, the deposit was also fairly uniform.

During the period of service the rate of flow ranged from 80,000,000 to 154,000,000 gallons per day and averaged 114,000,000 gallons. From Table 1 the depth of water over the baffle and the velocities at various rates are given.

The velocity at the entrance baffle is too high to secure satisfactory subsidence, as is evidenced by the fact that only the heavier particles of suspended matter settled out before the water had traveled nearly 100 feet. At baffle No. 1 the velocity ranged between

TABLE 1

Velocity of water over baffles in feet per second, basin No. 1

RATE OF PUMPING	BAFFLE AT ENTRANCE		BAFFLE NO. 1		BAFFLE NO. 2		SKIMMING WEIR	
	Average depth of water over baffle	Velocity	Average depth of water over baffle	Velocity	Average depth of water over baffle	Velocity	Average depth of water over baffle	locity
mil. gals. daily	*feet*	*feet per second*	*feet*	*feet per second*	*feet*	*feet per second*	*feet*	*feet per second*
80,000,000	1	1.15	4.3	0.25	5.5	0.19	1.9	0.60
100,000,000	1	1.46	4.3	0.31	5.5	0.24	1.9	0.75
114,000,000	1	1.65	4.3	0.35	5.5	0.27	1.9	0.86
128,000,000	1	1.84	4.3	0.39	5.5	0.31	1.9	0.97
140,000,000	1	2.01	4.3	0.44	5.5	0.34	1.9	1.06
154,000,000	1	2.20	4.3	0.48	5.5	0.37	1.5	1.16

0.25 and 0.48 foot per second, with an average of 0.35 foot. The result is apparently quite satisfactory at this baffle, and the velocity must have been nearly equal across the entire basin, as the mud deposits were nearly level, in marked contrast to the sloping surface of the mud as shown when the reservoir was cleaned on various occasions prior to the placing of this baffle.

At baffle No. 2 the velocity is somewhat lower than at baffle No. 1 on account of its top being at a greater depth below the water surface. The distribution of sediment at this baffle is not nearly so good as it is at baffle No. 1. The contour map shows the greater deposit on the south side of the basin. The indications are that the velocity over this baffle is a little too slow, and if its top had been raised from 1 to $1\frac{1}{2}$ feet higher, the probability is that a more uniform

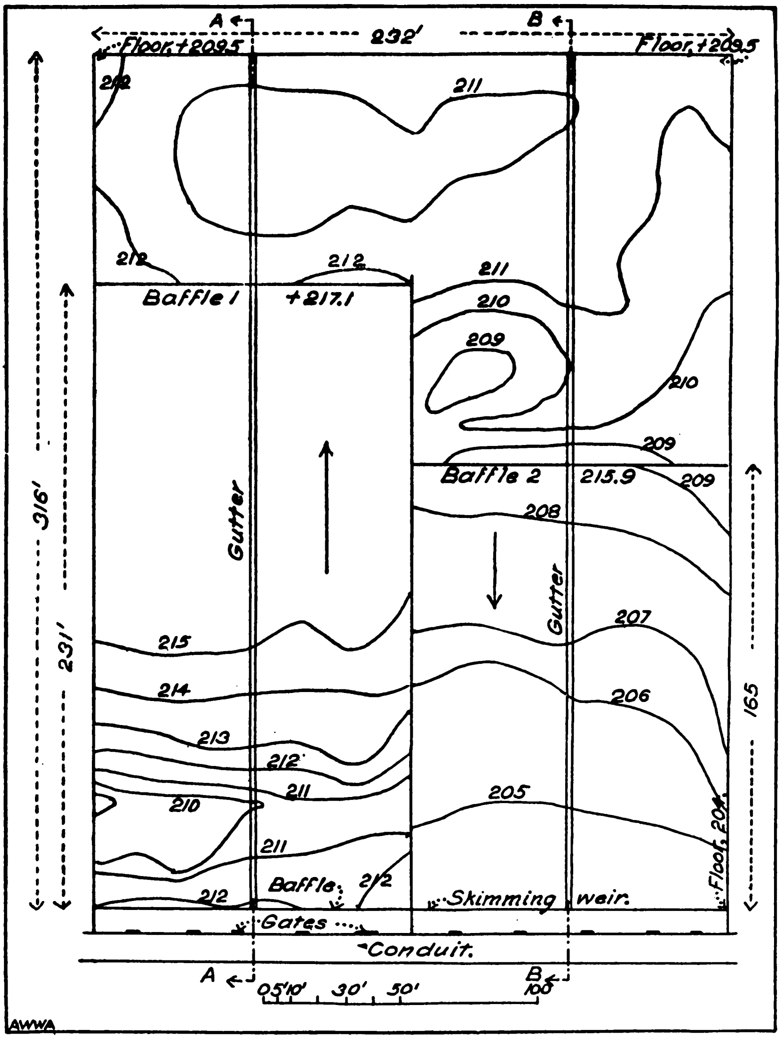

FIG. 1. SILT DEPOSIT IN COAGULATING BASIN 1 ON DECEMBER 31, 1919

The average difference in elevation of the mud surface at Baffle 1 is 2.1 feet, the average elevation on the building side being 215.4 feet. Average water level, 221.4 feet.

deposit of sediment would have been secured. The velocity of the water in passing over the skimming weir varies from 0.6 to 1.16 feet per second, and is, undoubtedly, too high for satisfactory results, as it was noticed on many occasions that sediment was picked up and carried over the weir. At times, when stop planks were removed from the baffles, a lighter and more uniform floc was noticed in the water as it passed though the gates to the filters.

In order to compare the subsiding value of basins No. 1 and No. 2, which are practically identical with the exception of added wooden

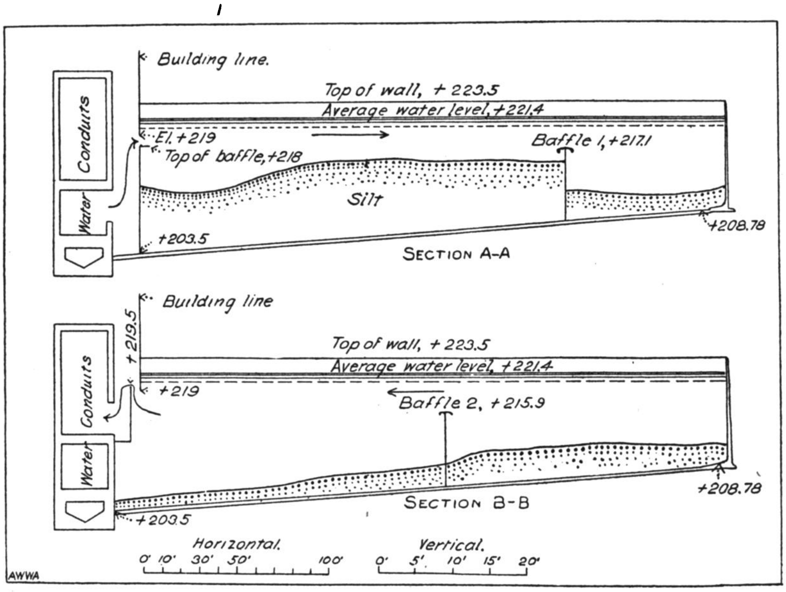

FIG. 2. PROFILES OF SILT DEPOSIT IN COAGULATING BASIN 1 ON DECEMBER 31, 1919

baffles in basin No. 1, a daily record of the turbidity has been made. The monthly averages are given in table 2, from January, 1919, to the end of March, 1920. The water entering the two basins was identical, having the chemicals incorporated in a common mixing chamber.

For the first five months in 1919, during which the wooden baffles in basin No. 1 were in a partially collapsed condition, the two basins did almost the same amount of work, basin No. 2 giving slightly better results. In June, basin No. 1 was thoroughly cleaned and the

baffles rebuilt. From that date until December, 1919, when the survey was made, basin No. 1 showed an average of 5.0 and basin No. 2 an average of 6.3 turbidity going onto the filters. Beginning with 1920, due to cold weather and bad water, it was impracticable to clean basin No. 1. As a number of storms occurred, bringing very heavy sediment to the plant, basin No. 1 was filled with mud to a height above the top of No. 1 baffle by the time it was cleaned on February 15. For a month and a half during this period of high turbidities, basin No. 1 did very much poorer work than No. 2 owing to the fact that it was nearly full of mud, but immediately after cleaning, it did very much better work than No. 2, as is shown by results in the table.

TABLE 2

Monthly average turbidity of effluent from coagulating basins

MONTH	BASIN 1	BASIN 2	MONTH	BASIN 1	BASIN 2	MONTH	BASIN 1	BASIN 2	MONTH	BASIN 1	BASIN 2
1919			*1919*			*1919*			*1920*		
January...	7.1	7.1	May...	7.0	5.0	September.	5.0	6.0	January....	8.5	9.9
February.	9.0	9.0	June...	4.6	6.7	October....	5.4	5.3	Feb. 1–14..	21.3	11.7
March....	9.0	9.0	July....	4.0	5.0	November..	5.5	6.8	Feb. 15–29..	6.2	8.8
April.....	8.0	8.0	August	5.0	7.0	December..	5.5	7.8	March......	8.2	14.0

Average, January to May, 1919, inclusive; basin 1, 8.0; basin 2, 7.6.
Average, June to December, 1919, inclusive; basin 1, 5.0; basin 2, 6.3.
Baffles were rebuilt in June, 1919.
Basin 1 was cleaned on February 15, 1920.

The observations seem to indicate that a velocity from 0.35 to 0.4 foot per second over the top of the baffle will give a fairly uniform flow, which will secure nearly equal subsiding values in all parts of the basin; that the velocity over the entrance baffle and skimming weir is too great, and that better results would probably be secured if it were reduced; that the efficiency of basin No. 1, even with the improper velocity at all the baffles except No. 1, is markedly better than No. 2, so much so that at times of high turbidity the difference in the effluents from the two basins is so great that it often presents a marked contrast to the eye.